

19. Arizona Fescue Ecological Series

Table 19-1. Full and short names for the ecological types in the Arizona Fescue Ecological Series.			
Ecological Type Code	Name	Plant Association Code	Short Name
GA02	Arizona fescue/pingue–Moderately deep to shallow residual Argiborolls, gravelly surface–Linear to convex exposed shoulders and summits, 8,400–9,600 ft	FEAR2/PIRI6	Arizona fescue/pingue–Shallow–Windward slopes
GA03	Arizona fescue/muhly–Shallow to deep colluvial Argiborolls, sometimes Lithic, gravelly surface–Linear to convex somewhat protected slopes, 8,700–10,500 ft	FEAR2/MUMO-MUFI	Arizona fescue/muhly–Deep–Windward slopes

This is the *Festuca arizonica* series of Komárková (1986) and of Moir (1983), who considers it a non-climatic series. It includes the Fescue series, in part, of Donart and others (1978) and Dick-Peddie (1993), and the *Danthonia parryi* series, in part, of Hess (1981) and Komárková (1986). It includes the *Muhlenbergia montana* series, the *Picradenia richardsonii* series, and the *Artemisia frigida* series of Komárková (1986).

Stands of this series occupy small- to medium-sized sites, which are usually easy to distinguish from sagebrush or other shrublands on aerial photos, though they are sometimes confused with black sagebrush sites. In the UGB, these sites occupy gravelly soils, often in rainshadow climates (Ramaley 1942). They occur on well-drained benches or in well-drained parks, usually above the lower tree line. Klemmedson (1983) discusses mineral and nutrient cycles.

Vegetation/Climate/Soils

Arizona fescue (*Festuca arizonica*) is an obligate outcrosser, so pollen must be transferred from one plant to another to set seed. The maximum distance between plants for successful pollination is 2-3 m (6-9 ft). Arizona fescue roots are shallow but densely matted, holding tightly to the upper few centimeters of soil, preventing erosion, and over time increasing its organic content. Sites are often windy, and the wind nearly always blows from the same direction, creating a hostile environment for soil formation.

Once Arizona fescue plants are more than 3-4 m (9-12 ft) apart, usually through grazing by livestock or big game, stands regress (Dayton and others 1937). Existing fescue plants senesce and die without reproducing. When the fescue root mats die, the organic-rich upper soil layer is free to erode, being removed through the action of wind or water from spring snowmelt. Eroded sites are effectively set back to primary succession; 1,000 years or more may be required for Arizona fescue to reestablish, probably during a favorable period of several decades with higher than normal moisture and less wind.

Once Arizona fescue is eliminated from a site, management can do little to reestablish it, and must instead manage the remaining less-palatable species, such as pingue, needle-and-thread, and junegrass, which reach peak growth in the spring. Loss of Arizona fescue considerably reduces the value of the forage on a site, especially in summer and fall for cattle, and in winter for elk.

Evaporation is typically great from these sites, and water percolates quickly through the soil. Arizona fescue and muhly counteract these forces. These plants and their litter on the soil surface hold much moisture and retain it through the growing season.

Total aboveground vegetation production in these sites can be as high as 1,700 lb/ac/yr when the site is in good to excellent condition (Aldon and Barstad 1987).

Table 19-2. Climate and Soils		
Characteristic	Value	Reference
Precipitation zone	510 mm/yr (420-600 mm/yr) 20 in/yr (16-24 in/yr)	Weaver 1979
Mean annual air temperature	8°C (-3°C to 18°C) 46°F (26°F to 64°F)	

Fire Management

Prescribed burning can increase long-term production of forage grasses, and typically increases their nutrient content and digestibility (Clary 1978). But these sites are usually too sparse to carry a fire, except possibly in conjunction with adjacent sagebrush sites.

Range and Wildlife Management

Early researchers were aware of the vulnerability of Arizona fescue to damage from grazing. Dayton and others (1937) noted that it is "not particularly resistant to grazing and even moderately close grazing tends to reduce the cover ... the greatest [range] damage usually occurs in the dry period of late spring and early summer before a vigorous, lush growth of the grass has been made. This damage is accentuated on poorly watered and

heavily stocked range. ... Care should be taken that the ranges are not overstocked, especially in the dry late spring and early summer period, and that uniform distribution is secured." Herzman and others (1967) observed that "Moderate to heavy grazing reduces the stand of Arizona fescue," while Judd (1962) noted that Arizona fescue "disappears quickly under close grazing and is thus a sensitive indicator of proper grazing management."

Sites supporting the same Arizona fescue grassland type as is found in the UGB are an important component of a low-elevation bighorn sheep winter range (but not the intermediate range or summer-lambing range) west of Saguache near the UGB. Within bighorn winter range, Arizona fescue (FEAR2), blue grama (CHGR15), fringed sage (ARFR4) and mountain muhly (MUMO) are major components of bighorn diets (Shepherd 1975).

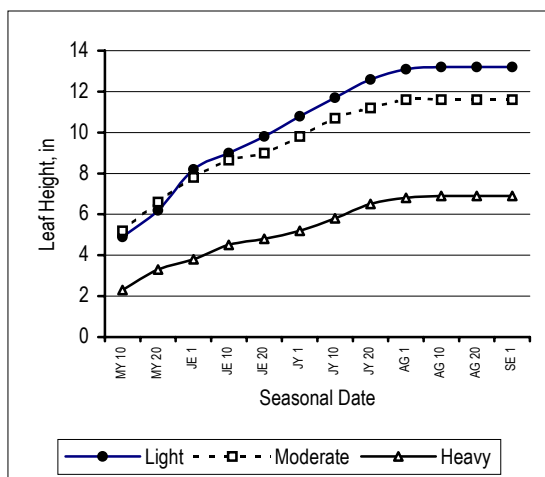


Figure 19-1. Growth in height of Arizona fescue (FEAR2) leaves in a ponderosa pine stand in east-central Colorado in three pastures with different cattle-use intensities (Johnson 1953).

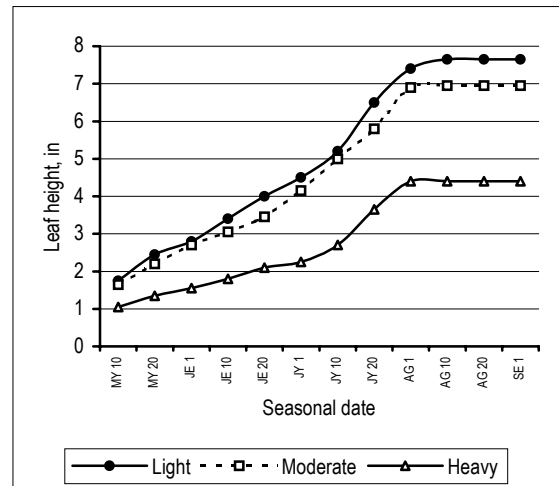


Figure 19-2. Growth in height of mountain muhly (MUMO) leaves in a ponderosa pine stand in east-central Colorado in three pastures with different cattle-use intensities (Johnson 1953)

Recreation, Roads & Trails, Scenery

Ridgetop or shoulder sites are unsuitable for developed or dispersed recreation because of shallow soils and high winds. More-protected sites are moderately suitable for recreational activities that do not disturb the soil, though they are probably less suitable for developed recreation. These sites are suitable for roads and trails, but roadbeds should be kept on or close to the surface, as cut banks do not hold very well in the gravelly soils. Sites on ridges are not suitable for construction because of high winds.

Revegetation and Rehabilitation

Arizona fescue is resistant to drought and trampling (Dayton and others 1937), but it produces few viable seeds even in dense stands, and even fewer germinate and survive (Dayton and others 1937), which presents problems for revegetation and for commercial seed growers. Arizona fescue is a prime candidate for local harvesting of seed for revegetation, but sites must be protected after seeding, a daunting task. Any revegetation effort is severely limited by the fact that erosion of the organic-rich topsoil (2-3 in deep) usually follows disturbance or any other decline of the fescue population. Needle-and-thread is one of the few native grasses that will grow in the subsoil of these sites.

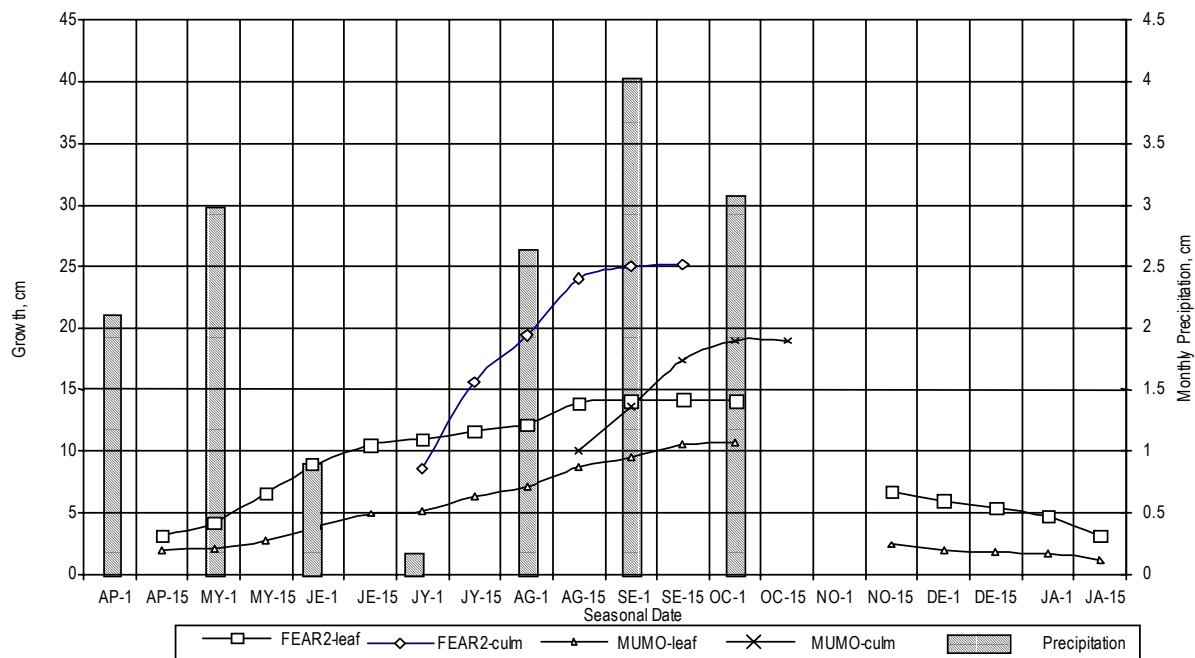


Fig. 19-3. Growth of Arizona fescue (FEAR2) and mountain muhly (MUMO) in ponderosa pine stands in northern Arizona (Pearson 1967). Notice that Arizona fescue apparently needs June and July drought to initiate culm growth.

Key to Ecological Types in the Arizona Fescue Series

1. Mountain muhly (MUMO), slimstem muhly (MUFI), or Parry oatgrass (DAPA2) present, and the sum of cover of these three species >10%; usually one or more of these three is conspicuous, >25% coverGA03
1. Mountain muhly and Parry oatgrass both absent; sometimes slimstem muhly present but always <5% cover ...
.....GA02

Table 19-3. Characteristics of Ecological Types within Ecological Series 19 in the Upper Gunnison Basin.
Numbers are shown in form Average (Minimum-Maximum)

Code Short Name	No. Samples	Elevation, ft	Avg. Aspect, °M (r) Slope, %	Soil Coarse, %	Depth, cm Mollic, cm	Surface: Coarse, % Bare, %	Cover, %: Trees Shrubs Graminoids Forbs	Total Live Cover, % No. Species TLC/NS, %
GA02 Arizona fescue/pingue- Shallow-Windward slopes	19	9,041 (8,420-9,520)	268 (0.86) 20 (6-34)	69 (36-87)	64 (26-162) 20 (7-40)	58 (24-77) 7 (1-19)	0 (0-0) 9 (0-21) 42 (18-73) 20 (5-67)	71.4 (43.7-140.9) 30 (22-39) 2.4 (1.4-4.1)
GA03 Arizona fescue/muhly- Deep-Windward slopes	20	9,669 (8,760-10,480)	166 (0.54) 25 (6-111)	54 (14-79)	54 (20-95) 22 (0-52)	30 (5-71) 31 (1-90)	0 (0-0) 7 (0-41) 59 (15-117) 22 (3-54)	88.1 (29.4-167.0) 27 (17-38) 3.4 (1.1-5.6)

Arizona fescue/pingue–Moderately deep to shallow residual Argiborolls, gravelly surface–
Linear to convex exposed shoulders and summits, 8,400–9,600 ft

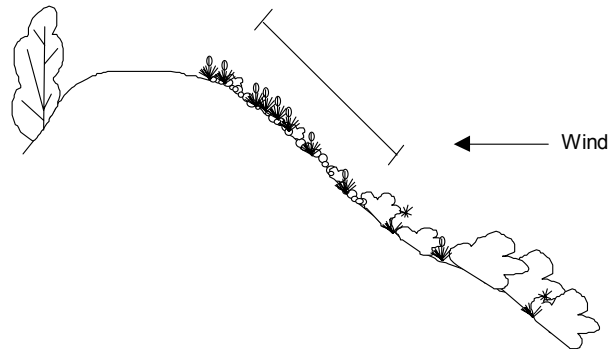


Figure 19-4. Cross-section of vegetation structure of *Arizona fescue/pingue–Shallow–Windward slopes*. Aspects are westerly, and slope angles average 21%.

Arizona fescue/pingue–Shallow–Windward slopes is a moderately common type on wind-exposed shoulders and summits with gravelly soils, usually in partial rainshadows. It is found on wind-scarred ridges in the lower part of the Gunnison Basin. This type probably occurs on both sides of the Continental Divide in Colorado, and perhaps elsewhere. *Arizona fescue/pingue–Shallow–Windward slopes* is characterized by Arizona fescue (FEAR2), pingue (PIR16), bottlebrush squirreltail (ELEL5), and prairie junegrass (KOMA). See Table 19-7 for common species names and codes. Other distinguishing features include location on wind-scarred ridges and shallow, gravelly soils.

Arizona fescue/pingue–Shallow–Windward slopes is related to *Indian ricegrass/needle-and-thread–Aridic soils–Windswept ridge shoulders*. The habitats and plant communities of these two ecological types overlap considerably, which might indicate that they are really the same type. However, *Indian ricegrass/needle-and-thread–Aridic soils–Windswept ridge shoulders* occurs mostly outside rainshadows, and has slightly less-coarse soils. Conversely, *Arizona fescue/pingue–Shallow–Windward slopes* occurs mostly within partial rainshadows on slightly coarser soils. *Arizona fescue/pingue–Shallow–Windward slopes* is also related to *Arizona fescue/muhly–Deep–Windward slopes*, which occurs at somewhat higher elevations, has fewer coarse fragments on the soil surface, and has one of the muhly species (MUMO, MUFI) conspicuously present.

Arizona fescue/pingue–Shallow–Windward slopes is also related to *Big sagebrush/Arizona fescue–Dark soils*, which occurs on more protected sites at somewhat higher elevations, has fewer coarse fragments on the surface, and is dominated by big sagebrush.

The plant association *Festuca arizonica/Picradenia richardsonii* is described as new here.

Primary succession is probably long, perhaps 1,000 years or more, because of the difficulty of forming the organic-rich upper soil layer in this windy environment, and the slow establishment of Arizona fescue. In addition, these sites are colder than surrounding sites in winter because the wind blows them free of snow, which could provide insulation from the colder air. Secondary succession is characterized by a prominent disclimax community which lacks Arizona fescue.

The following factors contribute to the difficulty of establishing Arizona fescue:

- Arizona fescue is an obligate outcrosser, so pollen must be transferred from one plant to another to set seed.
- The maximum distance between plants for successful pollination and seed set is 2 to 3 m.
- Arizona fescue roots are shallow but densely matted, holding tightly to the upper few centimeters of soil and preventing erosion; over time, these roots increase the organic content of the soil.
- Wind is constant on these sites, and nearly always blows from the same direction, creating a hostile environment for soil formation.

If Arizona fescue plants are reduced in density to more than 3 to 4 m apart (usually through grazing by livestock or big game), the stand will regress. The fescue plants grow old and die without any reproduction. As the fescue root mats die, the organic-rich upper soil layer is exposed to the erosional action of wind and spring snowmelt water from higher elevations. Elimination of this soil layer in effect sets the site back into primary succession, which means it could take another 1,000 years or more for Arizona fescue to re-establish, assuming there are several decades of higher than normal moisture and less wind to create favorable conditions. Once Arizona fescue has been eliminated, for management purposes these sites are lost, and management must deal with what remains, usually considerably less-

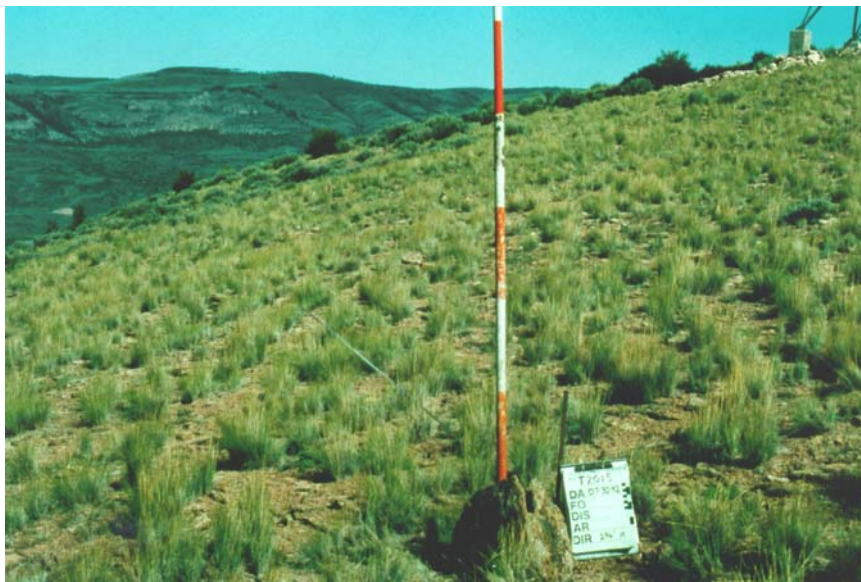
palatable species, notably needle-and-thread and pingue.

Bitterbrush-Big sagebrush/Arizona fescue communities occur on adjacent deeper soils and slightly more protected sites away from the ridgetops or shoulders. Douglas-fir or aspen forests or serviceberry shrublands adjoin this type on northerly or easterly slopes that are much more protected from wind.

Horizontal obstruction varies from very low to moderately low, averaging low. In spite of this, deer and elk may make intensive use of sites within their winter ranges, because they are free of snow all winter. In especially severe winters, these sites may be the only places not under snow. Deer will eat plants such as green rabbitbrush (CHVIP5), dwarf

rabbitbrush (CHDE2), winterfat, and fringed sagewort (ARFR4) in winter, making these sites an important part of deer and elk winter ranges.

Deer and elk use of community type A is moderate for rest and browse in mild winters, moderately high in severe winters, but very low in spring through fall. Deer and elk use of community types B and C is moderately low for rest and browse in mild winters, moderate in severe winters, and very low in spring through fall. Deer and elk use of community type D is low in mild winters for rest and browse, moderately low in severe winters, and very low spring through fall. These sites are too windy and exposed, with too little cover, to be of use to sage grouse.



Arizona fescue/pingue type in relatively good condition (Community Type A); this is about as dense as the vegetation ever gets. Arizona fescue 37% cover, blue grama 5%, Indian ricegrass 4%, fringed sage 3%. Coarse Fragments Cover = 70% (mostly gravel), Total Live Cover = 51%, Coarse Fragments in Soil = 40. Soil sampled as a Lithic/Aridic Haploboroll, Loamy-Skeletal, Mixed. Sapinero Quadrangle, elevation 8,610 ft, 21° 20' 22" (SSW) slope. July 30, 1992.

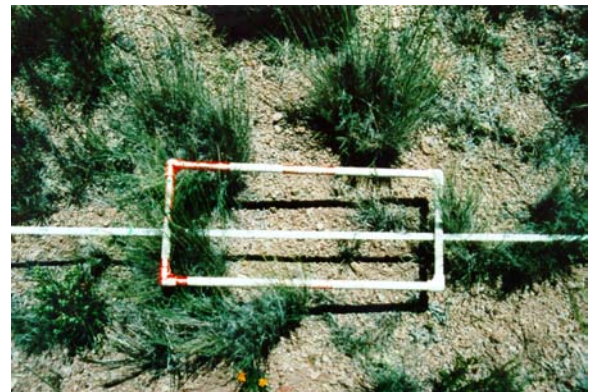
Summary of Ecological Type Characteristics

1. Explanation of symbols in Appendix A. Percentages in [brackets] indicate the percentage of plots sampled that have that characteristic.

NUMBER OF SAMPLES	18, soil descriptions from 14 of these (total 18)
ELEVATION	9,046 ft (8,420-9,520 ft); 2,757 m (2,566-2,902 m)
AVERAGE ASPECT	267°M (r = 0.86)
LITHOLOGY	Tuffs [68%], breccia [14%], and granite [9%]
FORMATIONS ¹	Taf-Tpl [84%], Xg [11%]
LANDFORMS	Mostly mesas and ridges [71%], some soil creep slopes [24%]
SLOPE POSITIONS	Mostly shoulders-summits [71%] and upper backslopes [10%]
SLOPE SHAPES	Linear [71%] to convex [29%] horizontally, Convex [53%] to linear [29%] vertically
SLOPE ANGLE	20.8% (8-34%)
SOIL PARENT MATERIAL	Residuum [65%] or colluvium [29%]
COARSE FRAGMENTS	57.8% (24-77%) cover on surface, 69.5% (36-87%) by volume in soil
SOIL DEPTH	64 cm (26-162 cm); 25.4 in (10-64 in)
MOLIC THICKNESS	20 cm (7-40 cm); 7.8 in (3-16 in)
TEXTURE	Surface is clearly loamy, with loam and silty loam leading; subsurface is clayey (sandy clay loam-clay-clay loam [63%]) to loamy (sandy loam-silty clay loam [21%])
SOIL CLASSIFICATION	Mostly Argiborolls [88%] of various kinds; moderately deep [57%] to shallow [21%]
TOTAL LIVE COVER	72.9% (50.8-140.9%)
NUMBER OF SPECIES	30.0 (22-39)
TOTAL LIVE COVER/NO. SPECIES	2.5% (1.6-4.1%)
CLIMATE	Hot in the summer, very cold in the winter, very dry (Aridic) Submontane. Evaporation from the surface (which is composed largely of coarse fragments) is significant because of the constant wind.
WATER	Precipitation is moderately low, but since the wind blows here nearly year-long, very little of that precipitation is available for plant growth. Soil is dry almost year-long.



An Arizona fescue/pingue site (Community Type A). Arizona fescue 38%, stemless actinea 5%, prairie junegrass 4%, pingue 4%, needle-and-thread 2%, Sandberg bluegrass 2%. Coarse Fragments Cover = 51%, Total Live Cover = 74%, Coarse Fragments in Soil = 37. Soil sampled as a Lithic Haploboroll, Loamy-Skeletal, Mixed. Houston Gulch Quadrangle, elevation 8,780 ft, 23° 324° (NW) slope. June 29, 1993.



A view at the ground surface along the transect shown obliquely in the photo at left. Abundant gravel cover. Although the space between the Arizona fescue plants appears to be barren, it is dominated by a dense mat of fescue roots. June 29, 1993.

Key to Community Types

1. Arizona fescue >30% cover **A**
1. Arizona fescue <30% cover (2)
2. Arizona fescue 20-30% cover **B**
2. Arizona fescue <20% cover (3)
3. Dominated by blue grama (CHGR15) or needle-and-thread (HECO26). Arizona fescue T-10%. Total live cover >75% **C**
3. Both blue grama and needle-and-thread secondary to Arizona fescue (5-25% cover). Total live cover <75% .. **D**

Description of Community Types

- A** *Arizona fescue-pingue-needle-and-thread* has Arizona fescue dominant, >30% cover. Other graminoids, forbs, and shrubs are sparse. Total graminoid cover is 35-55%.
- B** *Arizona fescue-junegrass-pingue* has Arizona fescue dominant, 20-30% cover. Total graminoid cover is 35-60%.
- C** *Blue grama-sedge-needle-and-thread-sparse Arizona fescue* is dominated by blue grama, 0-30% cover, or needle-and-thread, 0-35% cover. Arizona fescue is always present but subordinate, <10% cover. Total graminoid cover is 30-75%.
- D** *Arizona fescue-sage-sparse* has Arizona fescue the leading plant species, 5-20% cover. Other species are usually minor, <5% cover, except sometimes Sandberg bluegrass may be >10% cover. Total graminoid cover is 15-40%.

Table 19-4. Community types within *Arizona fescue/pingue-Shallow-Windward slopes*.

Community Type	No. samples	Elevation, ft Slope, %	Coarseness, % Depth, cm Mollic Depth, cm	Surface Coarse, % Bare, % Seral Stage	Layer Height, m	Avg Layer Cvr %	Cover, %: Trees Shrubs Graminoids Forbs	No. Species Total Live Cover, % TLC/NS, %	Prod. ¹ , lb/ac/yr Shrubs Gramin. Forbs	Obstruct'n %: 1.5-2.0 m 1.0-1.5 m 0.5-1.0 m 0.0-0.5 m Total<2m
A. Arizona fescue-pingue-needle-and-thread	3	8,940 (8,610-9,430) 20.0 (16-23)	77 (74-81) 47 (40-53) 18 (13-22)	65 (51-75) 3 (1-7) LS	GF 0.23 (0.0-0.7) S 0.20 (0.0-0.3) L 0.0	47.8 2.7 9.5	0 (0-0) 4 (0-11) 45 (40-50) 12 (5-20)	27 (25-30) 62 (51-74) 2.4 (1.7-2.9)	0-230 324-562 55-213	0 0 5 80 21
B. Arizona fescue-junegrass-pingue	6	9,178 (8,860-9,360) 20.5 (10-29)	72 (57-82) 79 (42-157) 18 (7-25)	60 (53-77) 8 (4-17) LM	GF 0.18 (0.0-0.7) S 0.14 (0.0-0.4) L 0.0	51.4 5.2 11.2	0 (0-0) 10 (6-15) 43 (35-55) 13 (7-19)	32 (25-36) 65 (55-78) 2.1 (1.6-2.7)	124-300 234-656 71-209	0 (0-0) 0 (0-0) 0 (0-0) 45 (30-75) 11 (8-19)
C. Blue grama-sedge-needle-and-thread-sparse Arizona fescue	6	9,045 (8,860-9,370) 20.3 (9-28)	63 (36-86) 69 (41-162) 25 (15-40)	50 (24-72) 5 (2-8) MS	GF 0.20 (0.0-0.7) S 0.16 (0.0-0.5) L 0.0	55.4 9.1 32.8	0 (0-0) 10 (2-21) 53 (35-73) 32 (10-67)	29 (22-39) 95 (83-141) 3.3 (2.8-4.1)	35-422 220-1016 110-345	0 (0-0) 0 (0-0) 0 (0-0) 35 (10-60) 9 (3-15)
D. Arizona fescue-fringed sage-sparse	4	8,905 (8,420-9,520) 18.7 (6-34)	69 (47-87) 50 (26-87) 17 (7-26)	62 (47-69) 12 (5-19) EM	GF 0.23 (0.0-1.3) S * L 0.0	41.8 5.2 1.6	0 (0-0) 7 (2-16) 24 (18-36) 21 (10-33)	32 (29-34) 53 (44-63) 1.6 (1.4-1.9)	30-334 78-254 111-330	0 (0-0) 0 (0-0) 0 (0-0) 23 (5-40) 6 (1-10)

*. Unknown: measurements were not taken in this CT.

Table 19-5. Wildlife values (relative to the whole UGB) for the principal wildlife species using *Arizona fescue/pingue–Shallow–Windward slopes*.

CT	Sage Grouse	Mule Deer	Elk
	Season–Preference	Season–Preference	Season–Preference
A	Spring-Mod. Low (Lek) Nesting-High Summer-Mod. High	Winter, Mild– Moderate (Rest, Browse) Winter, Severe– Mod. High (Rest, Browse) Spring/Fall– Very Low	Winter, Mild– Moderate (Rest, Browse) Winter, Severe– Mod. High (Rest, Browse) Spring/Fall– Very Low
B, C	Spring-Mod. Low (Lek) Nesting-Mod. High Summer-Mod. High	Winter, Mild– Mod. Low (Rest, Browse) Winter, Severe– Moderate (Rest, Browse) Spring/Fall– Very Low	Winter, Mild– Mod. Low (Rest, Browse) Winter, Severe– Moderate (Rest, Browse) Spring/Fall– Very Low
D	Spring-Mod. Low (Lek) Nesting-Low Summer-Mod. Low	Winter, Mild– Low (Rest, Browse) Winter, Severe– Mod. Low (Rest, Browse) Spring/Fall– Very Low	Winter, Mild– Low (Rest, Browse) Winter, Severe– Mod. Low (Rest, Browse) Spring/Fall– Very Low

Table 19-6. Resource Values for *Arizona fescue/pingue–Shallow–Windward slopes*. Resource values were calculated from the numbers in Table 19-4, relative to the whole UGB.

The numbers in this table can be translated: 0 = Very Low, 1 = Low, 2 = Moderately Low, 3 = Moderate, 4 = Moderately High, 5 = High, and 6 = Very High.

Resource Value	Community Type			
	A	B	C	D
Potential Cattle Forage Production	2-3	2-3	2-4	1-2
Grazing Suitability	3	3	3	2
Wetland	No	No	No	No
Riparian Area	No	No	No	No
Developed Recreation	1-2*	1*	0*	1*
Dispersed Recreation	0-1	0-1	0	0-1
Scenic	0-1	0-1	0-1	0-1
Road & Trail Stability	4-5	4-5	2-3	3
Construction Suitability	1-2*	1*	0*	1*
Deer & Elk Hiding Cover	0-1	0-1	0-1	0
Deer & Elk Forage & Browse	1-2	1-2	1	1
Need for Watershed Protection	1	1	1	1
Soil Stability	4-5	4-5	2-3	3
Risk of Soil Loss-Natural	3-4	3-4	4-5	3-4
Risk of Soil Loss-Management	2	2	3-4	2
Risk of Permanent Depletion-Range	1	1	1	1
Risk of Permanent Depletion-Wildlife	4-5	4-5	2-3	2-3
Resource Cost of Management	4-5	4-5	2-3	2-3
Cost of Rehabilitation	2	2	2	2

*. Not very suitable because too windy and exposed

Table 19-7. Common Species in *Arizona fescue/pingue–Shallow–Windward slopes*, where Characteristic cover > 10% or Constancy > 20%. "-" means that the species is not found. Dead cover is not listed. Ccv = Characteristic Cover, Con = Constancy. If Avc = Average Cover, then these are related using the formula $Avc = Ccv \cdot 100\% / Con$.

Community Type		A	B	C	D	Common Name
Code	Species	Ccv(Con) N = 3	Ccv(Con) 6	Ccv(Con) 6	Ccv(Con) 4	
SHRUBS						
ARNO4	Artemisia nova	1 (67)	1 (33)	– –	T (25)	black sagebrush
ARTR2	Artemisia tridentata	T (33)	2 (33)	T (17)	2 (50)	big sagebrush
CHNA2	Chrysothamnus nauseosus	1 (33)	2 (50)	T (17)	1 (25)	rubber rabbitbrush
CHVI8	Chrysothamnus viscidiflorus	5 (33)	1 (33)	8 (33)	1 (25)	Douglas rabbitbrush
CHVIP5	Chrysothamnus viscidiflorus ssp. pumilus	T (33)	1 (67)	2 (33)	6 (25)	green rabbitbrush
COVI9	Coryphantha vivipara	T (33)	– –	T (50)	– –	pincushion cactus
GUSA2	Gutierrezia sarothrae	– –	T (33)	4 (67)	– –	broom snakeweed
KRLA2	Krascheninnikovia lanata	T (33)	T (17)	1 (33)	– –	common winterfat
LEPU	Leptodactylon pungens	– –	T (33)	T (17)	2 (50)	granite gilia
PIRI6	Picradenia richardsonii	2(100)	5(100)	4 (83)	3 (75)	pingue
SYRO	Symphoricarpos rotundifolius	T (33)	T (50)	1 (33)	T (25)	mountain snowberry
TECA2	Tetradymia canescens	– –	1 (67)	1 (17)	2 (75)	gray horsebrush
GRAMINOIDS						
ACHY	Achnatherum hymenoides	4 (33)	T (17)	T (33)	T (25)	Indian ricegrass
CAFO3	Carex foenea	– –	– –	15 (17)	– –	silvertop sedge
CASTE3	Carex stenophylla ssp. eleocharis	T (33)	2 (17)	8 (50)	1 (50)	needleleaf sedge
CHGR15	Chondrosium gracile	4 (33)	2 (67)	17 (67)	5 (50)	blue grama
ELEL5	Elymus elymoides	3(100)	3(100)	3(100)	1 (50)	bottlebrush squirreltail
FEAR2	Festuca arizonica	35(100)	24(100)	2(100)	10(100)	Arizona fescue
HECO26	Hesperostipa comata	1(100)	9 (50)	24 (83)	2 (75)	needle-and-thread
KOMA	Koeleria macrantha	5 (67)	8(100)	5 (67)	5 (50)	prairie junegrass
MUFI	Muhlenbergia filiculmis	– –	1 (17)	T (17)	2 (50)	slimstem muhly
POSE	Poa secunda	1 (33)	3 (83)	10 (33)	7 (75)	Sandberg bluegrass
FORBS						
ANSE4	Androsace septentrionalis	T (33)	T (50)	1 (17)	T (25)	northern rock-jasmine
ANRO2	Antennaria rosea	1 (33)	1 (50)	– –	3 (25)	rose pussytoes
ARFR4	Artemisia frigida	2(100)	1 (83)	8 (83)	3(100)	fringed sagewort
ASAN4	Astragalus anisus	T (33)	1 (67)	T (17)	T (50)	Gunnison milkvetch
CALI4	Castilleja linariifolia	T (33)	T (17)	1 (33)	T (50)	Wyoming paintbrush
ERCO24	Eremogone congesta	– –	T (17)	3 (33)	6 (25)	desert sandwort
ERCO27	Erigeron concinnus	– –	12 (17)	2 (33)	2 (75)	Navajo fleabane
EREA	Erigeron eatonii	14 (33)	1 (50)	3 (50)	1 (25)	Eaton fleabane
LESU3	Lepidotheca suaveolens	– –	4 (67)	19 (17)	1 (75)	pineapple weed
PASE	Paronychia sessiliflora	1 (67)	2 (33)	2 (17)	4 (25)	creeping nailwort
PECA4	Penstemon caespitosus	2 (67)	1 (67)	1 (33)	3 (25)	beardtongue
PHHO	Phlox hoodii	1 (33)	2 (50)	2 (50)	1 (25)	Hood's phlox
PHMU3	Phlox multiflora	– –	– –	33 (17)	T (25)	flowery phlox
POPE8	Potentilla pensylvanica	– –	T (17)	4 (33)	2 (50)	Pennsylvania cinquefoil
SPCO	Sphaeralcea coccinea	T (33)	T (17)	2 (33)	T (25)	scarlet globe mallow
TETO	Tetranneuris torreyana	– –	T (33)	14 (17)	3 (50)	Torrey's hymenoxys
GROUND COVER						
.BARESO	bare soil	3(100)	8(100)	5(100)	12(100)	
.LITTER	litter and duff	32(100)	30(100)	44(100)	25(100)	
.GRAVEL	gravel 0.2-10 cm	26	27	23	18	
.COBBLE	cobble 10-25 cm	9 (67)	8 (83)	7 (67)	23(100)	
.STONES	stone > 25 cm	10 (67)	2 (33)	5 (50)	7 (50)	
.MOSSON	moss on soil	– –	2 (67)	1 (17)	– –	
LICHENS	lichens on soil	10	10	28	5	

Arizona fescue/muhly-
Shallow to deep colluvial Argiborolls, sometimes Lithic, gravelly surface-
Linear to convex somewhat protected slopes, 8,700-10,500 ft

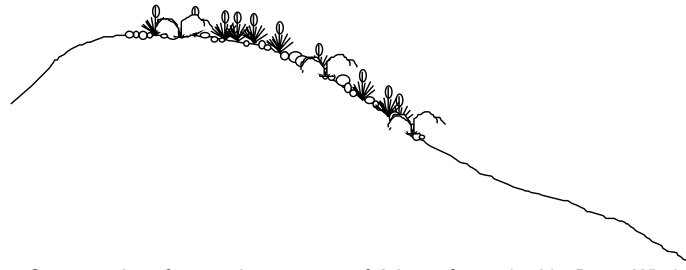


Figure 19-5. Cross-section of vegetation structure of *Arizona fescue/muhly-Deep-Windward slopes*. Aspects are southerly, and slope angles average 25%.

Arizona fescue/muhly-Deep-Windward slopes is an uncommon type on moderate to steep, somewhat protected slopes, on soils with gravelly surfaces, in partial rainshadows. In the Gunnison Basin, it occurs in parks and on benches within rainshadow climates. This type has been described from southern Colorado, northern New Mexico and northern Arizona. *Arizona fescue/muhly-Deep-Windward slopes* is characterized by Arizona fescue (FEAR2) and mountain muhly (MUMO) or slimstem muhly (MUFI). Some sites in better condition support Parry oatgrass (DAPA2) as well. See Table 19-10 for common species names and codes. Another distinguishing characteristic is Argiboroll soils.

Arizona fescue/muhly-Deep-Windward slopes is related to *Arizona fescue/pingue-Shallow-Windward slopes*, which occurs on more exposed slopes at somewhat lower elevations and on coarser soils, and lacks muhly. *Arizona fescue/muhly-Deep-Windward slopes* is also related to *Thurber-Arizona fescues-Deep cold dark soils*, which occurs on more protected slopes at higher elevations, has much less coarse soil surfaces, and supports conspicuous Thurber fescue (FETH).

The two muhlies (mountain and slimstem) seem to replace each other on these sites. Some sites have conspicuous amounts of one or the other, and other sites have both. The plant association *Festuca arizonica/Muhlenbergia* spp. is described as new here, based on *Festuca arizonica/Muhlenbergia montana* (Shepherd 1975, Clary 1978, and Radloff 1978); it is also based on *Muhlenbergia montana/Festuca arizonica* (Johnston 1987).

Primary succession takes a moderately long time in these somewhat protected sites, probably 400-500 years. Secondary succession lasts around 200 years, and certain circumstances will produce a disclimax community which lacks Arizona fescue. The following factors are important to succession on these sites:

- Arizona fescue is an obligate outcrosser, so pollen must pass from one plant to another to

set seed. The maximum distance between plants for seed set is 2 to 3 m.

- Arizona fescue roots are shallow but densely matted, holding tightly to the upper few centimeters of soil, preventing erosion and over time increasing soil organic content.
- The wind is nearly constant in these sites, and nearly always from the same direction, creating a hostile environment for soil formation.

If Arizona fescue plants are depleted to the point that they are more than 3 to 4 meters apart (usually though grazing by livestock or big game), stands regress. Fescue plants senesce and die without any reproduction. As the fescue root mats die, the organic-rich upper soil layer is free to erode. Water, or wind on more exposed sites, erodes the soil, setting the site effectively back to primary succession conditions. It may be 500 years or more before Arizona fescue can re-establish, probably over a period of several decades of higher than normal moisture and less wind. For management purposes, once Arizona fescue is eliminated, it is gone, and less-palatable species are the only ones available.

This situation is somewhat complicated when Parry oatgrass is present (in Phase 1). Parry oatgrass is a mat-forming grass with a very tight root structure, that is more palatable than either of the fescues but which is more resistant to grazing because of its mat-forming habit. Parry oatgrass is a vigorous competitor with other plant species. It can easily outcompete much taller plants. It is difficult to tell whether oatgrass is an obligate outcrosser or not because of its vigorous vegetative reproduction.

Big sagebrush/Parry oatgrass-Arizona fescue communities adjoin this type on deeper soils with less gravel, more large coarse fragments, and more clay. One of the tall willow types (or the “mountain meadows” seral to them) occur in wet to moist adjacent bottoms. Douglas-fir, lodgepole pine, upland blue spruce, or spruce-fir forests border this type on shallower non-Mollic soils and steeper slopes.

Horizontal obstruction varies from very low to moderately low, averaging low. In spite of this, deer and elk make intensive use of sites within their winter ranges because these sites blow free of snow all winter. In especially severe winters, these sites may be the only places free of snow. Deer will eat plants such as green rabbitbrush (CHVIP5), dwarf rabbitbrush (CHDE2), winterfat, and fringed sagewort (ARFR4) on these sites in winter, making them an important part of deer and elk winter ranges. Deer and elk use of all community types is moderate for browse in mild winters and moderately high in severe winters, but moderately low spring through fall. These sites are too windy and exposed, with too little cover, to be of use to sage grouse.

Summary of Ecological Type Characteristics

1. Explanation of symbols in Appendix A. Percentages in [brackets] indicate the percentage of plots sampled that have that characteristic.

NUMBER OF SAMPLES	20, soil descriptions from 11; 2 not assigned to a CT (total 22)
ELEVATION	9,669 ft (8,760-10,480 ft); 2,947 m (2,670-3,194 m)
AVERAGE ASPECT	166°M (r = 0.54)
LITHOLOGY	Igneous, for example tuff and welded tuff [58%], breccia-basalt-rhyolite [33%]; so far no sedimentary
FORMATIONS ¹	Taf [64%], Tpl-Tbb-Tiq [32%]
LANDFORMS	Soil creep slopes [78%], benches and ridges [17%]
SLOPE POSITIONS	Primarily backslopes, footslopes, and toeslopes [90%]
SLOPE SHAPES	Linear [61%] to convex [33%] horizontally, Linear [67%] to concave [28%] vertically
SLOPE ANGLE	25.1° (6-111°)
SOIL PARENT MATERIAL	Mostly colluvium [72%]
COARSE FRAGMENTS	30.0% (5-71%) cover on surface, 53.6% (14-79%) by volume in soil
SOIL DEPTH	54 cm (20-95 cm); 21.4 in (8-37 in)
MOLLIC THICKNESS	22 cm (0-52 cm); 8.6 in (0-20 in)
TEXTURE	Surface is clay loam (silty clay loam-sandy clay loam-clay loam [64%] Subsurface is mixed, often clay-sandy clay loam-sandy clay [76%]
SOIL CLASSIFICATION	Argiborolls primarily [63%], and some Haploborolls [44%]; more Lithic soils than usual [38%]
TOTAL LIVE COVER	88.1% (29.4-166.9%)
NUMBER OF SPECIES	26.7 (17-38)
TOTAL LIVE COVER/NO. SPECIES	3.4% (1.1-5.6%)
CLIMATE	In deep rainshadow. Warm, exposed to sun, somewhat exposed to wind. Hot in the summer, very cold in the winter, very dry (Aridic) Submontane. Evaporation from the surface (which is composed largely of coarse fragments) is significant because of the constant wind.
WATER	Dry microclimate, but vegetation cover and coarse fragments hold some moisture through the season on better-condition sites. No permanent water on or near sites. Precipitation is moderately low, but since the wind blows here nearly year-long, very little of that precipitation is available for plant growth. Soil is dry almost year-long.

Key to Community Types

1. Parry oatgrass conspicuous, >10% cover, often >25% **A**
1. Parry oatgrass absent or <10% (2)
2. Total graminoid cover <30%. Arizona fescue <10%, usually <2% cover. Parry oatgrass absent **D**
2. Total graminoid cover >30%. Arizona fescue usually >5% cover. Parry oatgrass usually present, 0-10% cover(3)
3. Arizona fescue >13% cover, usually >20% **B**
3. Arizona fescue <13% cover, usually <10% **C**

Description of Community Types

- A** *Parry oatgrass-mountain muhly-Arizona fescue* Parry oatgrass is dominant with >30% cover. Arizona fescue (5-15% cover), and one of the muhlies (5-40% cover) are always present. Total graminoid cover is high, >65%.
- B** *Arizona fescue-muhly* Arizona fescue is dominant with >13%. Sometimes one of the muhlies is codominant. Parry oatgrass is usually present but subordinate, with 0-10% cover. Total graminoid cover is moderately high, 50-85%.
- C** *Muhly-Arizona fescue* is dominated by one or both of the muhlies with 20-60% cover. Arizona fescue is always present at 0-15% cover. Parry oatgrass is usually absent, but sometimes as much as 5% cover. Total graminoid cover is moderately high, 50-80%.
- D** *Muhly-sparse* One of the muhlies is always present at 5 to 30%. Arizona fescue is always present in small amounts, T-5% cover. Other graminoids are sparse. Total graminoid cover is low, <30%.

Communities Not Assigned to a Community Type

- One community is dominated by Parry oatgrass, with Arizona fescue a significant subdominant, but lacks muhly (neither mountain nor slimstem). Total graminoid cover is high, >100%. This community would fit CT A except for the lack of muhly.
- One community is dominated by muttongrass (POFE) and Rocky Mountain fescue (FESA), but lacks muhly. Total graminoid cover is high, >100%. Rocky Mountain fescue tends to replace Arizona fescue in other community types, and this site seems to be roughly in the same range as other community types. This site may represent another, uncommon ET.

Table 19-8. Community types within *Arizona fescue/muhly-Deep-Windward slopes*.

Community Type	No. samples	Elevation, ft Slope, %	Coarseness, % Depth, cm Mollic Depth, cm	Surface Coarse, % Bare, % Seral Stage	Layer Height, m	Avg Layr Cvr %	Cover, %: Trees Shrubs Graminoids Forbs	No. Species Total Live Cover, % TLC/NS, %	Prod. ¹ , lb/ac/yr Shrubs Gramin. Forbs	Obstruct'n %: 1.5-2.0 m 1.0-1.5 m 0.5-1.0 m 0.0-0.5 m Total<2m
A. Parry oatgrass- mountain muhly-Arizona fescue	5	9,840 (9,440-10,480) 19.1 (8-32)	64 (57-71) 65 (48-88) 21 (0-52)	17 (6-30) 18 (1-35) PN	S 0.30 (0.0-0.4) GF 0.15 (0.0-0.6) M 0.0 L 0.0	T 81.4 0.5 1.5	0 (0-0) 4 (0-10) 83 (67-117) 22 (13-50)	28 (24-31) 109 (85-167) 3.9 (3.3-5.6)	0-205 905-1329 182-338	0 (0-0) 0 (0-0) 0 (0-0) 30 (20-40) 8 (5-10)
B. Arizona fescue-muhly	6	9,897 (9,080-10,400) 39.5 (11-111)	55 (30-68) 51 (30-76) 26 (10-40)	32 (14-58) 30 (18-65) LS	S 0.20 (0.0-0.5) GF 0.18 (0.0-0.7) M 0.0 L 0.0	3.0 66.9 T 1.4	0 (0-0) 5 (0-9) 66 (51-83) 23 (12-33)	29 (22-38) 93 (68-112) 3.3 (2.6-4.1)	3-187 580-1154 176-330	0 (0-0) 0 (0-0) 0 (0-0) 35 (25-40) 9 (6-10)
C. Muhly- Arizona fescue	5	9,502 (9,120-10,410) 24.5 (7-63)	46 (14-79) 59 (20-95) 18 (2-36)	36 (10-62) 27 (6-55) LM	S 0.20 (0.0-0.5) GF 0.18 (0.0-1.0) M 0.0 L 0.0	2.4 54.9 0.3 3.7	0 (0-0) 8 (0-16) 57 (51-76) 16 (3-37)	27 (18-35) 81 (69-99) 3.2 (2.3-4.7)	8-324 567-1058 38-334	2 (0-5) 10 (0-30) 17 (0-50) 42 (20-60) 18 (5-36)
D. Muhly-sparse	4	9,320 (8,760-9,640) 11.8 (6-22)	45 (28-63) 32 (20-43) 21 (16-26)	37 (5-71) 54 (15-90) EM-MS	S 0.15 (0.0-0.3) GF 0.18 (0.0-0.5) M 0.0 L 0.0	0.3 31.9 1.1 2.2	0 (0-0) 13 (0-41) 21 (15-26) 29 (14-54)	22 (17-26) 62 (29-90) 3.1 (1.1-4.6)	9-678 64-115 207-338	0 0 0 20 5

*. Unknown: measurements were not taken in this CT.

Table 19-9. Resource Values for <i>Arizona fescue/muhly-Deep-Windward slopes</i> . Resource values were calculated from the numbers in Table 19-8, relative to the whole UGB.				
The numbers in this table can be translated: 0 = Very Low, 1 = Low, 2 = Moderately Low, 3 = Moderate, 4 = Moderately High, 5 = High, and 6 = Very High.				
Resource Value	Community Type			
	A	B	C	D
Potential Cattle Forage Production	3-4	3-4	3-4	0-1
Grazing Suitability	3	2	2	0-1
Wetland	No	No	No	No
Riparian Area	No	No	No	No
Developed Recreation	1-2*	1*	0*	1*
Dispersed Recreation	0-1	0-1	0	0-1
Scenic	0-1	0-1	0-1	0-1
Road & Trail Stability	4-5	4-5	2-3	3
Construction Suitability	1-2*	1*	0*	1*
Deer & Elk Hiding Cover	0	0-1	0-2	0
Deer & Elk Forage & Browse	2-3	2-3	1-2	0-1
Need for Watershed Protection	1	2-3	2	1
Soil Stability	4-5	3	3-4	4
Risk of Soil Loss-Natural	3-4	4-5	4	3-4
Risk of Soil Loss-Management	2	3	3	2
Risk of Permanent Depletion-Range	1	1-2	1	1
Risk of Permanent Depletion-Wildlife	4-5	4-5	4-5	4-5
Resource Cost of Management	4-5	4-5	4-5	4-5
Cost of Rehabilitation	4-5	4-5	4-5	4-5

*. Not very suitable because too windy and exposed



One of the highest-seral stands in the *Arizona fescue/muhly* type (Community Type A), with Parry oatgrass conspicuous giving the light yellow-green color, in deep rainshadow. These sites are open, but much more protected than the sites in the *fescue/pingue* type. Mountain muhly 38% cover, Parry oatgrass 31%, pingue 10%, horse cinquefoil 6%, *Arizona fescue* 5%, slimstem muhly 3%. Coarse Fragments Cover = 30%, Total Live Cover = 101%, Coarse Fragments in Soil = 29. Soil sampled as a Typic or Lithic Eutroboralf, Clayey-Skeletal, Smectitic. Saguache Park Quadrangle, elevation 9,720 ft, 19° 105° (ESE) slope. August 6, 1992.

Table 19-10. Common Species in *Arizona fescue/muhly-Deep-Windward slopes*, where Characteristic cover > 10% or Constancy > 20%. "-" means that the species is not found. Dead cover is not listed. Ccv = Characteristic Cover, Con = Constancy. If Avc = Average Cover, then these are related using the formula $Avc = Ccv \cdot 100\% / Con$.

Community Type		A	B	C	D	Common Name
Code	Species	Ccv (Con)	Ccv (Con)	Ccv (Con)	Ccv (Con)	
		N = 5	6	5	4	
SHRUBS						
CHNA2	Chrysothamnus nauseosus	T (40)	T (67)	T (40)	4 (50)	rubber rabbitbrush
CHPA13	Chrysothamnus parryi	T (40)	3 (33)	3 (40)	– –	Parry rabbitbrush
CHVI8	Chrysothamnus viscidiflorus	– –	1 (17)	1 (40)	3 (25)	Douglas rabbitbrush
JUCO6	Juniperus communis	– –	– –	16 (20)	– –	common juniper
PIRI6	Picradenia richardsonii	4 (80)	3 (67)	5 (60)	13 (75)	pinque
GRAMINOIDS						
CHGR15	Chondrosium gracile	2 (20)	– –	3 (40)	5 (25)	blue grama
DAPA2	Danthonia parryi	38 (100)	3 (67)	1 (40)	– –	Parry oatgrass
ELEL5	Elymus elymoides	1 (40)	1 (100)	1 (60)	T (50)	bottlebrush squirreltail
FEAR2	Festuca arizonica	9 (100)	24 (100)	6 (100)	2 (100)	Arizona fescue
FESA	Festuca saximontana	2 (20)	4 (50)	5 (60)	T (25)	Rocky Mountain fescue
KOMA	Koeleria macrantha	4 (100)	12 (83)	13 (60)	7 (75)	prairie junegrass
MUFI	Muhlenbergia filiculmis	3 (60)	16 (50)	19 (80)	10 (25)	slimstem muhly
MUMO	Muhlenbergia montana	22 (100)	24 (67)	27 (80)	12 (75)	mountain muhly
POFE	Poa fendleriana	6 (60)	1 (50)	1 (20)	– –	muttongrass
FORBS						
ANSE4	Androsace septentrionalis	T (40)	T (33)	T (20)	T (75)	northern rock-jasmine
ANRO2	Antennaria rosea	2 (80)	4 (83)	2 (80)	4 (50)	rose pussytoes
ARFR4	Artemisia frigida	1 (80)	1 (50)	3 (80)	17 (75)	fringed sagewort
ERFE3	Eremogone fendleri	2 (80)	4 (50)	1 (20)	4 (50)	desert sandwort
EREA	Erigeron eatonii	2 (20)	1 (17)	6 (20)	3 (25)	Eaton fleabane
ERSU2	Erigeron subtrinervis	2 (80)	6 (83)	1 (20)	– –	threenerve fleabane
ERSU2	Erigeron subtrinervis	2 (80)	6 (83)	1 (20)	– –	threenerve fleabane
ERSU2	Erigeron subtrinervis	2 (80)	6 (83)	1 (20)	– –	threenerve fleabane
GADR3	Gastrolychnis drummondii	T (40)	– –	T (20)	T (25)	alpine campion
HEVI4	Heterotheca villosa	15 (20)	3 (17)	1 (40)	23 (25)	hairy golden aster
IPAG	Ipomopsis aggregata	– –	1 (67)	– –	T (25)	trumpet gilia
OXL3	Oxytropis lambertii	1 (20)	T (33)	T (20)	– –	Lambert crazyweed
PECA4	Penstemon caespitosus	2 (40)	– –	1 (40)	– –	beardtongue
PEST2	Penstemon strictus	– –	1 (50)	T (20)	– –	Mancos penstemon
POCO13	Potentilla concinna	– –	1 (33)	1 (40)	– –	elegant cinquefoil
POHI6	Potentilla hippiana	4 (100)	4 (83)	3 (80)	2 (75)	horse cinquefoil
TAOF	Taraxacum officinale	1 (40)	T (50)	T (20)	– –	common dandelion
VICA14	Virgulus campestris	– –	1 (17)	T (60)	– –	western meadow aster
GROUND COVER						
.BARESO	bare soil	18 (100)	30 (100)	27 (100)	54 (100)	
.LITTER	litter and duff	65 (100)	37 (100)	36 (100)	9 (100)	
.GRAVEL	gravel 0.2-10 cm	8	16	9	24	
.COBBLE	cobble 10-25 cm	2 (20)	3 (67)	7 (80)	6 (50)	
.STONES	stone > 25 cm	12 (20)	2 (17)	9 (60)	– –	
.MOSSON	moss on soil	7 (20)	T (17)	T (60)	2 (25)	
LICHENS	lichens on soil	3	2	4	4	

Table 19-11. Wildlife values (relative to the whole UGB) for the principal wildlife species using <i>Arizona fescue/muhly-Deep-Windward slopes</i> .			
CT	Sage Grouse	Mule Deer	Elk
	Season-Preference	Season-Preference	Season-Preference
All	Spring-Mod. Low (Lek) Nesting-High Summer-Mod. High	Winter, Mild- Moderate (Browse) Winter, Severe- Mod. High (Browse) Spring/Fall- Mod. Low	Winter, Mild- Moderate (Forage, Browse) Winter, Severe- Mod. High (Forage, Browse) Spring/Fall- Mod. Low